Summary by WG to Address the Future of RHIC Physics via High p_T Observables

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Recall 7 questions from last WS

#1 What is the nature of the phase transition between nuclear matter and quark matter(…)? How does hadronization work? Is there evidence for deconfinement?

#2 How does the clearly evident thermodynamic character of a high-energy heavy-ion collision evolve ...? How does the collision thermalize so quickly?

#3 What are the properties of the strongly-coupled quark-gluon plasma? …

#4 Is chiral symmetry restored? …

…

High-pT measurements relate to #1-3, perhaps #4

Main **Physics Questions:**

- Interactions w/ QCD medium
  - What is the mechanism of energy loss?
  - How do jets affect the medium?
- Hadronization
  - How does it occur in

    p+p, A+A, in various pT regimes?
- Initial conditions
  - nuclear wave functions (CGC)
  - thermalization

More specific **Physics Questions**

- Energy loss
  - Collisional vs. radiative? (jet energy and length dependence)
  - Interaction dependence? (quarks vs. glue, heavy vs light quarks)
  - Particle and energy distribution in near/away-side jet cones
  - Energy density determination (upper/lower limits, number of degrees of freedom)
- Hadronization
  - fragmentation, coalescence regimes? Percolation?
  - Mass generation and relation to hadronization

Theoretical challenges:

- What exactly does energy loss (e.g., q-hat) "measure"?
- Is R_{AA} suppression consistent with elliptic flow?
- Spacetime evolution of medium (necessary input)
- Effect of a propagating hard parton on medium
- Consistent description of intermediate pT region - coalescence/recombination, soft physics tails…
- Calculation of particle correlations

- What can distinguish between models?
- Consistency between conclusions that come from different models?

Measurements to do:

- γ– jet and leading hadron –γ correlations
- Identified particle R_{AA}, and v_2 , and correlations
  - Out to 10+ GeV/c, ideally 30 (to see flat R_{AA} change)
  - Baryon vs. meson – will v2 scaling disappear?
  - Forward vs. central rapidity
- Near and away-side jet cones
  - Energy distribution
  - Shape (eta-phi)
  - Flavor
- Multi-dimensional tomography: pT-Φ-Ψ_{rp} – η1 –η2
- Heavy vs light flavor at high pT
- P+p, p+A, A+A, A+B(!) – and especially U+U
- Gluon jets (J/psi – jet correlations)
- Leading hadron – dilepton correlations; resonances in jets (in near/away-side correlations)

Next steps

Continue compilation of high-pT predictions waiting to be tested

Calculations needed from the theory community

- Up-to-date gamma-jet rates
- Identified di-hadron correlations at high pT
- At what pT can we really measure dead-cone effect (D vs. B)?
- Energy loss predictions for asymmetric systems and U+U
- Multidimensional hadron correlations (eg., “octupole twist”)
- Where in pT does the “pQCD” region begin?
- RHIC vs LHC (thermalization time, interaction strength,…)

Detector simulations/estimates needed

- Detector capability comparisons (STAR, PHENIX, R2D)
  – IN PROGRESS

one issue: Direct gammas - rate estimates and methods to separate fragmentation gammas from truly direct gammas